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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/068,819	02/05/2002	Ford Grigg	01-0371	8861

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EXAMINER	
MCHENRY, KEVIN L	
ART UNIT	PAPER NUMBER
1725	6

DATE MAILED: 10/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/068,819	GRIGG ET AL.	
	Examiner	Art Unit	
	Kevin L McHenry	1725	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _06 August 2003_ .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _32-62_ is/are pending in the application.

4a) Of the above claim(s) _32-62_ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _32-62_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _5_ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 32-38, 40 and 58-62 are rejected under 35 U.S.C. 103(a) as being unpatentable over Abe et al. (U.S.P. 6,402,013) in view of Glenn et al. (U.S.P. 5,482,736).

Abe et al. teach a soldering process for electronic components such as semiconductor packages that uses a flux (see U.S.P. 6,402,013; particularly column 1, lines 5-11; column 3, lines 63-67; column 4, line 1). The flux includes a polymer epoxy resin, a fluxing agent such as a carboxylic acid or carboxylic acid anhydride, and a curing agent such as a solvent or reactant. The resin would be electrically insulative. Particularly, ethylene glycol is a solvent that will cross-link with epoxies and carboxylic acid anhydride is a reactant that will serve as a curing agent. Abe et al. teach that the curing agent and the fluxing agent can be the same chemical, such as when carboxylic acid anhydride is used (see U.S.P. 6,402,013; particularly column 2, lines 1-60; column 5, lines 8-40, 47-60; column 6, lines 1-14, 25-48; for information on solvents acting as epoxy curing agents, see U.S.P. 5,851,311; particularly column 3, lines 1-8; column 6, lines 55-66). Abe et al. teach that this flux can be used with solder balls or can be mixed with a solder powder to form a solder paste. The flux is viscous and is applied by screen printing or transfer to a location to be soldered. The paste can be applied by a means

such as screen printing. After application of the flux or paste, solder reflow is performing through appropriate means (see U.S.P. 6,402,013; particularly column 4, lines 15-39; column 7, lines 3-6, 15-19, 55-61).

Abe et al. do not teach that the electronic components have contact pads, a mechanism for placement of the solder balls, or that reflow is performed in a two stage furnace.

Glenn et al. teach a soldering method for electronic components in which solder flux is applied to a package to form a droplet on the surface of contact pads. A ball transfer mechanism, such as a jig, is used to place solder balls on the solder droplets (see U.S.P. 5,482,736; particularly Figures 1, 3, and 9; column 1, lines 5-10; column 3, lines 27-67). The droplets support the balls and have a thickness between one tenth to one half the diameter of the solder ball. Glenn et al. teach that a furnace can be used for solder reflow (see U.S.P. 5,482,736; particularly Figure 3; column 3, lines 64-67).

It would have been obvious to one of ordinary skill in the art at the time that the applicant's invention was made to have modified the process of Abe et al. by the teachings of Glenn et al. One would have been motivated to do so in order to use a jig as a solder ball transfer mechanism, as taught by Glenn et al. One of ordinary skill in the art would have been motivated to provide contact pads on the semiconductor package in order to provide means for an electronic connection between the package and mounted devices. One of ordinary skill in the art would have been motivated to use a two stage furnace so that the first stage could be used to preheat the workpiece or to drive off moisture from the workpiece while the second stage is used for reflowing. Alternatively, a two stage furnace could be used where the first stage is for reflowing and the second

stage is for cooling the workpiece. As noted by Abe et al., the polymer material is viscous and this material would have the property of be a non-flowing substance at room temperature.

3. Claims 41-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Abe et al. (U.S.P. 6,402,013) in view of Soderlund et al. (U.S.P. 5,611,476) and Glenn et al. (U.S.P. 5,482,736).

Abe et al. teach a soldering process for electronic components such as semiconductor packages that uses a flux (see U.S.P. 6,402,013; particularly column 1, lines 5-11; column 3, lines 63-67; column 4, line 1). The flux includes a polymer epoxy resin, a fluxing agent such as a carboxylic acid or carboxylic acid anhydride, and a curing agent such as a solvent or reactant. The resin would be electrically insulative. Particularly, ethylene glycol is a solvent that will cross-link with epoxies and carboxylic acid anhydride is a reactant that will serve as a curing agent. Abe et al. teach that the curing agent and the fluxing agent can be the same chemical, such as when carboxylic acid anhydride is used (see U.S.P. 6,402,013; particularly column 2, lines 1-60; column 5, lines 8-40, 47-60; column 6, lines 1-14, 25-48; for information on solvents acting as epoxy curing agents, see U.S.P. 5,851,311; particularly column 3, lines 1-8; column 6, lines 55-66). Abe et al. teach that this flux can be used with solder balls or can be mixed with a solder powder to form a solder paste. The flux is viscous and is applied by screen printing or transfer to a location to be soldered. The paste can be applied by a means such as screen printing or transfer. After application of the flux or paste, solder reflow is

performing through appropriate means (see U.S.P. 6,402,013; particularly column 4, lines 15-39; column 7, lines 3-6, 15-19, 55-61).

Abe et al. do not teach that the electronic components have contact pads or that a conveyor is used to move the component.

Soderlund et al. teach a solder reflow furnace with a conveyor for moving component between furnace zones. Soderlund et al. teach that this furnace will minimize the buildup of condensed flux and solvent on components within the furnace (see U.S.P. 5,611,476; particularly column 1, lines 7-8, 60-63; column 4, lines 1-10).

Glenn et al. teach a soldering method for electronic components in which solder flux is applied to a package to form a droplet on the surface of contact pads. A ball transfer mechanism, such as a jig, is used to place solder balls on the solder droplets (see U.S.P. 5,482,736; particularly Figures 1, 3, and 9; column 1, lines 5-10; column 3, lines 27-67). The droplets support the balls and have a thickness between one tenth to one half the diameter of the solder ball. Glenn et al. teach that a furnace can be used for solder reflow (see U.S.P. 5,482,736; particularly Figure 3; column 3, lines 64-67).

It would have been obvious to one of ordinary skill in the art at the time that the applicant's invention was made to have modified the process of Abe et al. by the teachings of Soderlund et al. and Glenn et al. One would have been motivated to use the furnace of Soderlund et al. in order to provide a reflow means that minimized the buildup of condensed flux and solvent on components within the furnace. One would have been motivated to use a jig as a solder ball transfer mechanism, as taught by Glenn et al. One of ordinary skill in the art would have been motivated to provide contact pads

on the semiconductor package in order to provide means for an electronic connection between the package and mounted devices.

4. Claims 32-43 and 45-62 are rejected under 35 U.S.C. 103(a) as being unpatentable over Farnworth et al. (U.S.P. 6,180,504) in view of Abe et al. (U.S.P. 6,402,013).

Farnworth et al. teach a soldering process for electronic components such as semiconductor packages by using a polymer support layer that is formed on the semiconductor substrate. The polymer support is formed by depositing a polymer material such as polyimide, silicone, or epoxy onto the bonding pads of the substrate (see U.S.P. 6,180,504; particularly column 5, lines 27-35, 60-65; column 6, lines 48-52). When using epoxies, a solvent can be used as a curing agent. This support material would be electrically insulative. Farnworth et al. teach that the polymer material cures to form a support for solder balls (see U.S.P. 6,180,504; particularly column 5, lines 60-63; column 7, lines 63-65; column 8, lines 63-67). This reference also teaches that the thickness of the polymer material is equal to or less than one half of the diameter of the solder balls and the polymer material can form a ring shape (see U.S.P. 6,180,504; particularly column 6, lines 25-31; column 8, lines 1-6).

Farnworth et al. do not teach the polymer support material includes a flux, a means for dispensing the polymer support material, that the polymer material can include solder particles, or that reflowing is performed in a furnace.

Abe et al. teach a soldering process for electronic components such as

semiconductor packages that uses a flux (see U.S.P. 6,402,013; particularly column 1, lines 5-11; column 3, lines 63-67; column 4, line 1). The flux includes a polymer epoxy resin, a fluxing agent such as a carboxylic acid or carboxylic acid anhydride, and a curing agent such as a solvent or reactant. The resin would be electrically insulative. Particularly, ethylene glycol is a solvent that will cross-link with epoxies and carboxylic acid anhydride is a reactant that will serve as a curing agent. Abe et al. teach that the curing agent and the fluxing agent can be the same chemical, such as when carboxylic acid anhydride is used (see U.S.P. 6,402,013; particularly column 2, lines 1-60; column 5, lines 8-40, 47-60; column 6, lines 1-14, 25-48; for information on solvents acting as epoxy curing agents, see U.S.P. 5,851,311; particularly column 3, lines 1-8; column 6, lines 55-66). Abe et al. teach that this flux can be used with solder balls or can be mixed with a solder powder to form a solder paste. The flux is viscous and is applied by screen printing or transfer to a location to be soldered. The paste can be applied by a means such as screen printing. After application of the flux or paste, solder reflow is performed in an oven (see U.S.P. 6,402,013; particularly column 4, lines 15-39; column 7, lines 3-6, 15-19, 55-61; column 9, lines 1-10).

It would have been obvious to one of ordinary skill in the art at the time that the applicant's invention was made to have modified the process of Farnworth et al. by the teachings of Abe et al. One would have been motivated to do so in order to include a flux in the polymer material to clean the area to be joined and improve wettability of solder to the area and to provide an oven as a reflow means, as taught by Abe et al. It would have be obvious to one of ordinary skill to have included solder particles, as taught by Abe et al., in the polymer taught by Farnworth et al. as opposed to keeping the

polymer and solder material separate, as taught by Farnworth et al., because of the art recognized functional equivalence of polymer material mixed with solder particles and polymer material separate from solder material (i.e. both are suitable means for joining semiconductor substrates to components).

One of ordinary skill in the art would have been motivated to use a two stage furnace so that the first stage could be used to preheat the workpiece or to drive off moisture from the workpiece while the second stage is used for reflowing. Alternatively, a two stage furnace could be used where the first stage is for reflowing and the second stage is for cooling the workpiece. As noted by Abe et al., the polymer material is viscous and this material would have the property of be a non-flowing substance at room temperature.

5. Claim 44 is rejected under 35 U.S.C. 103(a) as being unpatentable over Farnworth et al. (U.S.P. 6,180,504) in view of Abe et al. (U.S.P. 6,402,013) as applied to claims 32-43 and 45-62 above, and further in view of Soderlund et al. (U.S.P. 5,611,476).

The former references teach the process described above in section 4. However, these references do not teach that a conveyor is used to move the component.

Soderlund et al. teach a solder reflow furnace with a conveyor for moving component between furnace zones. Soderlund et al. teach that this furnace will minimize the buildup of condensed flux and solvent on components within the furnace (see U.S.P. 5,611,476; particularly column 1, lines 7-8, 60-63; column 4, lines 1-10).

It would have been obvious to one of ordinary skill in the art at the time that the applicant's invention was made to have modified the process described above by the

teachings of Soderlund et al. One would have been motivated to use the furnace of Soderlund et al. in order to provide a reflow means that minimized the buildup of condensed flux and solvent on components within the furnace and to provide a means of automatically moving components through a furnace.

Response to Amendment

6. Upon carefully reviewing applicant's amendment filed 6 August 2003, the examiner acknowledges the cancellation of claims 1-31, the amendments to claims 32-34, 39, 41, 42, 46 and the addition of claims 53-62. The former 112 rejections are withdrawn in view of applicant's amendments.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the

advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Response to Arguments

8. Applicant's arguments filed 6 August 2003 have been fully considered but they are not persuasive.

The applicant argues that Abe et al. do not teach a polymer support means, particularly a cured droplet of polymer resin. While Abe et al. teach that curing is performed during reflow rather than before reflow, the examiner notes that the applicant has used comprising language. This language allows additional structures, such as a solder joint, to be included along with the cured polymer support. Therefore, the teachings of Abe et al. read upon the claimed cured polymer support.

The applicant argues that Glenn et al. do not teach polymer support members. As noted above in section 2, Abe et al. teaches the polymer support members.

The applicant argues that there is no motivation to combine Abe et al. and Glenn et al. However, as noted in section 2, Glenn et al. does provide teachings and motivation for this combination. The examiner notes the applicant's argument that one of ordinary skill would likely have known to use contact pads and a mechanism to place the solder balls on the substrate. However, as noted in section 2, these features are not taught by Abe et al. and the teachings of Glenn et al. are relied upon to show that these features can be used in conjunction with the process of Abe et al.

The applicant argues that the teachings of the references noted above do not teach a polymer support where solder particles in the polymer material coalesce to form

a solder bump. As noted in sections 2 and 4 above, Abe et al. teach that the polymer material can be used separately from solder material or that solder particles can be imbedded in the polymer material, just as the applicant claims. The applicant does not argue why these solder particles would not coalesce; they only argue that this is not taught. The examiner notes that these solder particles would coalesce into a solder bump during reflow since the solder will become molten and these molten droplets will coalesce because of surface tension. Also, as noted in sections 3 and 5 above, Soderlund et al. do provide motivation for modifying the processes of Abe et al. and Farnworth et al.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin L McHenry whose telephone number is (703) 305-9626. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas G Dunn can be reached on (703) 308-3318. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1234.

Kevin McHenry

M. ALEXANDRA ELVE
PRIMARY EXAMINER